NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

PASTURE AND HAY PLANTING
(Acre)
CODE 512

DEFINITION
Establishing native or introduced forage species.

PURPOSES
This practice may be applied as part of a resource management system to accomplish one or more of the following purposes:

- Establish adapted and compatible species, varieties, or cultivars.
- Improve or maintain livestock nutrition and/or health.
- Extend the length of the grazing season.
- Provide emergency forage production.
- Reduce soil erosion by wind and/or water.
- Improve or renovate species growing on pasture or hayland.

CONDITIONS WHERE PRACTICE APPLIES
This practice may be applied on *existing* hayland, pastureland, and other agricultural lands including cropland where conversion to forage production is feasible and desired.

CRITERIA

General criteria applicable to all the purposes stated above.
Plant species and their cultivars shall be selected based upon:

- Intended use: hay, rotational grazing.
- Climatic conditions, such as annual rainfall, seasonal rainfall patterns, growing season length, humidity levels, temperature extremes and the USDA Plant Hardiness Zones.
- Soil condition and position attributes such as pH, available water holding capacity, aspect, drainage class, inherent fertility, salinity and alkalinity, flooding and ponding, and levels of toxic elements that may be present such as selenium and aluminum.
- Plant resistance to disease and insects common to the site or location.
- Plant compatibility with other forage species and their selected cultivar(s) in rate of establishment, maturity, and growth habit when seeded together as a forage mixture.

Species Selection

Species planned for pasture or hayland should be compatible with the planned management of the entire operating unit. Select species that provide forage of the desired quality for grazing or hay as appropriate. Forage suitability groups in section II of the Field Office Technical Guide provide a list of suggested species suited to that forage suitability group, based on the predominant soil type.

Seedings for both pasture & hay may be pure stands of legumes or grasses, or legume-grass mixtures. Mixtures will have a recommended seeding rate of 50 – 70 seeds per square foot.

For ease of management hayland mixtures will include no more than two grass species having similar growth habits and similar seasons of use. Warm season grasses and cool season grasses shall not be mixed. No more than two legume species with similar growth habit and similar season of use may be added to the grasses. See standard 511, Forage Harvest Management, for specifications on cutting and removal of forage. Pasture mixtures may include more species than hay mixtures. The landuser should be aware of the bloat hazard of some legumes when they are included in pasture mixes.

NRCS, Minnesota
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See Tables 1 and 2 for seeding rates and mixtures that are suited for use in Minnesota. Acceptable varieties of introduced grasses and legumes shall be selected from those listed in the most current University of Minnesota Varietal Trials publication. Approved varieties of native grasses are listed in Table 3. When named varieties are not used, utilize seed from as near as possible to the area being seeded. Seed with a variety not stated (VNS) shall be from a source no more than 200 miles north or 150 miles south of the area to be seeded, and have an origin of one of the states that surround Minnesota (Wisconsin, Iowa, North and South Dakota). Additional grasses and legumes not listed may be used if they are adapted to Minnesota.

Liming and Fertilizing

Amounts of liming material and fertilizer to be applied will be determined by soil tests. Refer to Nutrient Management (590) to develop fertilizer and lime recommendations.

When possible, apply lime at least six months before seeding mixtures that include legumes, and incorporate to a depth of three inches. If lime is not incorporated, it is best to apply it 1 to 2 years ahead of seeding.

When doing conventional seeding, fertilizer can be applied and incorporated before seeding. Manure can also be applied and incorporated before seeding. When interseeding or doing no-till, phosphorus and potassium can be applied with the interseeder or drill, or topdressed ahead of seeding.

Seeding Methods

Interseeding No-till into Existing Stands: When interseeding, the existing species are not killed, only suppressed to allow establishment of more productive grasses and legumes. Interseeding is most effective in over utilized Kentucky bluegrass sod. Forage production from pastures can be improved by the inclusion of more productive grasses (bromegrass, orchardgrass, etc.) and legumes. Existing smooth bromegrass and other tall grasses are especially competitive and make legume establishment more difficult. Red clover is the easiest legume to interseed into a suppressed tall grass sod.

Control perennial and biennial broadleaf weeds with appropriate herbicide the year before sod seeding. Complete control often requires more than one herbicide application. Refer to standard 595, Pest Management.

Before planting the new seed, the existing species must be suppressed. In the summer and fall before seeding, graze heavily or clip to a height of one inch; or in the spring apply a burn down herbicide at a suppression rate just prior to seeding when plants reach about 4 inches in height. Use a no-till drill to seed into the sod at a depth of ¼ to ½ inch. Grain drills or other conventional forage seeding equipment will not work.

Periodic flash grazing during the establishment year is essential to controlling competition of existing grasses with the new seedlings.

No-Till Seeding: This procedure is especially applicable on steep, highly erodible soils. On land currently in grass, all existing vegetation is killed with herbicides, preferably in the fall prior to planting. Quackgrass and many broadleaf weeds are easier to control when herbicides are fall applied rather than spring applied. On cropland, leave the existing crop residue. With fall herbicide application, an additional burndown chemical may be needed in the spring prior to planting to kill any weeds and regrowth.

New, more desirable forage species are seeded into the old sod or existing crop residue. Seedbed preparation is accomplished during the seeding operation. Use a no-till drill and plant at a depth of ¼ to ½ inch.

Conventional Seeding into a tilled seedbed: A seedbed will be prepared that is free of all competing vegetation and is not subject to erosion. All existing vegetation will be killed prior to or during seedbed preparation with tillage and/or herbicides. Seeding on fields with significant weed populations will be delayed until weeds are controlled. If chemical methods are used, multiple applications may be required to achieve satisfactory results.

A firm seedbed will be provided in all cases. The seedbed shall be tilled to a depth of at least three inches. It shall be reasonably smooth, friable, firm, free of competing vegetation and

contain enough fine soil particles for uniform shallow coverage of the seed as well as contact with moisture and nutrients. As a general rule, a seedbed is considered firm enough when the foot tracks left by an adult are no deeper than one-half inch. Seedbeds that are too soft may be firmed by harrowing, packing with two or more passes with an empty drill, or cultipacker.

Grass and legumes shall be seeded immediately following the final seedbed preparation. A companion crop is recommended to be seeded with all species except the warm season grasses. An early maturing variety of oats with good lodging resistance is the most desirable small grain for use as a companion crop. Barley and spring wheat may also be used. The seeding rate of the companion crop will be 50% or less of the normal rate of seeding for that crop. They may be planted before or along with the grass and legume seeding. Mow and remove companion crop residue at the boot stage or graze when it is approximately 10 inches tall to prevent it from going to seed.

Grasses and legumes shall be drilled uniformly over the area at a depth of ¼ to ½ inch using a grassland drill, grain drill with press wheels, cultipacker seeder or by broadcasting and cultipacking before and after broadcasting the seed. Cultipacker seeders most consistently assure shallow seed placement. If a grain drill with a legume seed box is used, seed tubes should be positioned to deposit seed behind the coulters or openers which seed small grains. When a cyclone or endgate type seeder is used, the large and light seeded grasses will be sown as a separate operation from the legume or large, heavy seeded grasses.

Frost Seeding: This method is used only to interseed legumes into existing cool season pastures. Broadcast the legume seed on top of the existing stand in late winter (late February and March) when freezing and thawing help to incorporate the seed into the soil. The soil surface is usually honeycombed with small cracks. Frost seedings shall not be made on areas covered with ice, but must be made before the frost is out. Because of their greater seedling vigor and higher rate of germination, red and white clovers are the legumes best suited to frost seeding.

Periodic flash grazing during the establishment year is essential to control competition of the existing grasses with the new seedings.

Seed

Seeding rates will be calculated on a pure live seed (PLS) basis. The percent PLS for each species being planted is computed by multiplying the percent germination (includes hard seed) times the percent purity and dividing the product by 100. The amount of bulk seed to be planted is calculated by dividing the PLS lbs /ac to be seeded by the % PLS of the bulk seed.

All seed and planting materials shall be labeled and meet state seed quality law standards.

Legume seed shall be inoculated with the proper, viable rhizobia before planting. When more than one legume species is used, each species will be inoculated separately.

Seeding Periods

Date of seeding is a critical factor in determining whether a seeding will succeed or fail. Late summer seeding is generally more risky than spring seeding, but weed competition during late summer is generally less. Planting at either end of the allowable range is more risky than the middle of the range. Seeding dates are as follows: (see figure 1):

Frost seeding: February – March

Cool Season Grasses and Legumes

	Spring	Late Summer
North	April 1 – June 15	July 15 – August 15
South	April 1 – June 1	August 1 - August 20

Warm Season Grasses

North	May 15 – July 1
South	May 15 – June 15

Additional criteria for improving or maintaining livestock nutrition and/or health.

Forage species must be capable of meeting the desired level of nutrition for the kind and class of the livestock to be fed.

Additional criteria for extending the grazing season.

Forage species selected for establishment shall fulfill a recognized dietary requirement within the yearlong forage management program.

Criteria for providing emergency forage production.

Select plants that will produce forage for use during periods when other on-farm/ranch forage is unavailable to meet livestock needs.

Criteria for reducing erosion by wind and/or water.

Plants shall have the ability to provide adequate ground cover, canopy cover, root mass, and vegetal retardance to wind forces and water flows either alone or in combination with other forage species when site conditions require erosion protection.

CONSIDERATIONS

Prescribed Burning (338), Prescribed Grazing (528A), and Brush Management (314) practices may be used in combination with Pasture and Hay Planting.

Where wildlife management is an objective, the food and cover value of the planting can be enhanced by using an approved habitat evaluation procedure to aid in selecting plant species and providing for other habitat requirements necessary to achieve the objective.

Forage species planted in mixture should exhibit similar palatability to one another to avoid spot or selective grazing.

PLANS AND SPECIFICATIONS

Specifications for the establishment of pasture and hay plantings shall be prepared for each site or management unit according to the Criteria, Considerations, and Operations and Maintenance described in this standard, and shall be recorded on specification sheets, job sheets, in narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

Growth of seedlings or sprigs shall be monitored for water stress. Water stress may require reducing weeds, early harvest of any companion crops, irrigating when possible or replanting failed stands.

Invasion by undesirable plants shall be controlled by cutting, using a selective herbicide, prescribed burning, or by grazing management by manipulating livestock stocking rates, density, and duration of stay.

Insects and diseases shall be controlled when an infestation exceeds economic injury levels.

REFERENCES

Forage Legumes, University of Minnesota Station Bulletin 597-1993.

Forage Crop Management Manual, Dr. Neal Martin and Dr. Greg Cuomo, University of Minnesota.

Pastures for Profit, University of Wisconsin-Extension and Minnesota Extension Service.

Perennial Forage Crop Establishment- University of Minnesota Extension Service publication AG-F)-0441, revised 1985.

“Pasture Renovation to Increase Forage Production” – Dr. Greg Cuomo and Dennis Johnson, University of Minnesota.

Minnesota Varietal Trials Results, MP 105-2001N.

Table 1 Seeding Rates, Lb. PLS/ac

Legumes	Pure Stand	In Mixture	Seeds / lb.
Alfalfa	12	7	220,000
Red Clover	10	7	275,000
White Clover	3	1	800,000
Alsike Clover	5	2	700,000
Sweetclover	10	3	260,000
Kura Clover	5	4	800,000
Cicer Milkvetch	12	5	130,000
Ladino Clover	3	1	800,000
Introduced Cool Season Grasses			
Smooth Bromegrass[1]	16	10	136,000
Meadow Bromegrass	22	16	80,000
Timothy	6	3	1,230,000
Orchardgrass[2]	-	4	654,000
Tall Fescue[3]	10	7	227,000
Creeping Foxtail	4	-	900,000
Crested Wheatgrass	8	-	175,000
Intermediate Wheatgrass	20	0-50%	88,000
Tall Wheatgrass	20	0-50%	79,000
Native Cool Season Grasses			
Canada Wildrye	15	0-20%	115,000
Western Wheatgrass	15	0-50%	112,000
Reed Canarygrass[4]	7	5	526,000
Warm Season Grasses			
Big Bluestem	10	0-100%	165,000
Indiangrass	10	0-50%	175,000
Switchgrass	6	0-50%	260,000
Little Bluestem	8	0-30%	261,360
Sideoats Grama	8	0-30%	191,664

1. Smooth Bromegrass has a high potential for invasiveness. Use should be avoided adjacent to existing native prairie or other sensitive areas.
2. Orchardgrass is recommended only in a mixture and only in southern and forest areas of Minnesota.
3. Use Endophyte free seed.
4. Use only the low- alkaloid varieties of Palaton and Venture.

Table 2: Mixtures Recommended in Minnesota; Other mixtures may be used.

Species	Rate – PLS[1] Pounds Per Acre	Suitable For [2] Hay	Pasture
1. Alfalfa	7		
Smooth Bromegrass [3]	10	1	1
2. Alfalfa	7		
Orchardgrass	3	2	1
3. Alfalfa	7		
Timothy	3	2	2
4. Alfalfa	7		
Smooth Bromegrass [3]	5		
Orchardgrass	2	2	1
5. Red Clover	7		
Smooth Bromegrass [3]	10	3	2
6. Red Clover	7		
Orchardgrass	4	3	2
7. Red Clover	7		
Timothy	3	3	2
8. Red Clover	7		
Smooth Bromegrass [3]	5		
Orchardgrass	2	2	2
9. Alsike Clover	2		
Ladino Clover	1		
Smooth Bromegrass[3]	10	2	1
(or Timothy)	3		
10. Alsike Clover	2		
Red Clover	7		
Smooth Bromegrass[3]	10	2	1
(or Timothy)	3		
11. Big Bluestem	5		
Indiangrass	3		
Switchgrass	1	2	1
12. Switchgrass	5		
Big Bluestem	10	2	1

1. PLS = Pure Live Seed (germination x purity).
2. Suitability rating is for the mixture: 1 – Preferred; 2 – Second Choice; 3 – Not recommended for this purpose.
3. Smooth Bromegrass has a high potential for invasiveness. Use should be avoided adjacent to existing native prairie or other sensitive areas.

TABLE 3: RECOMMENDED NATIVE GRASS VARIETIES

		ADAPTABILITY ZONE RATINGS 1/				
SPECIES	**VARIETY**	**A**	**B**	**C**	**D**	**E**
Switchgrass	Forestburg	1	1	1	2	3
	Sunburst	1	1	1	2	3
	Nebraska 28	1	1	2	3	4
	Summer	1	2	3	4	4
	Dacotah	3	2	1	1	1
	Pathfinder	2	2	3	4	4
Big Bluestem	Bonilla	1	1	1	2	3
	Champ	1	1	2	3	4
	Rountree	1	2	3	4	4
	Pawnee	1	2	3	4	4
	Bison	3	2	1	1	1
Indiangrass	Holt	1	1	2	3	4
	Oto	2	3	4	4	4
	Tomahawk	2	1	1	1	1
Canada Wildrye	Mandan Statewide					
Western Wheatgrass	Rodan Statewide					
Little Bluestem	Itasca Germplasm	1	1	1	1	1
	Badlands Ecotype	2	1	1	1	1
	Camper	2	3	3	4	4
	Blaze	2	3	3	4	4
Sideoats Grama	Pierre	1	1	1	2	3
	Butte	1	1	2	3	4
	Trailway	1	2	3	4	4
	Killdeer	4	3	2	1	1

Local seed sources of the above species may be used if it has been tested for germination and purity and if the seed is used within 300 miles north or 200 miles south of the seed origin.

1/ ADAPTABILITY ZONE RATINGS: 1= Adapted with optimum performance; 2= Moderately adapted under haying or grazing; may not always produce mature seed; 3= Poorly adapted; 4=Not adapted. See Figure 2.

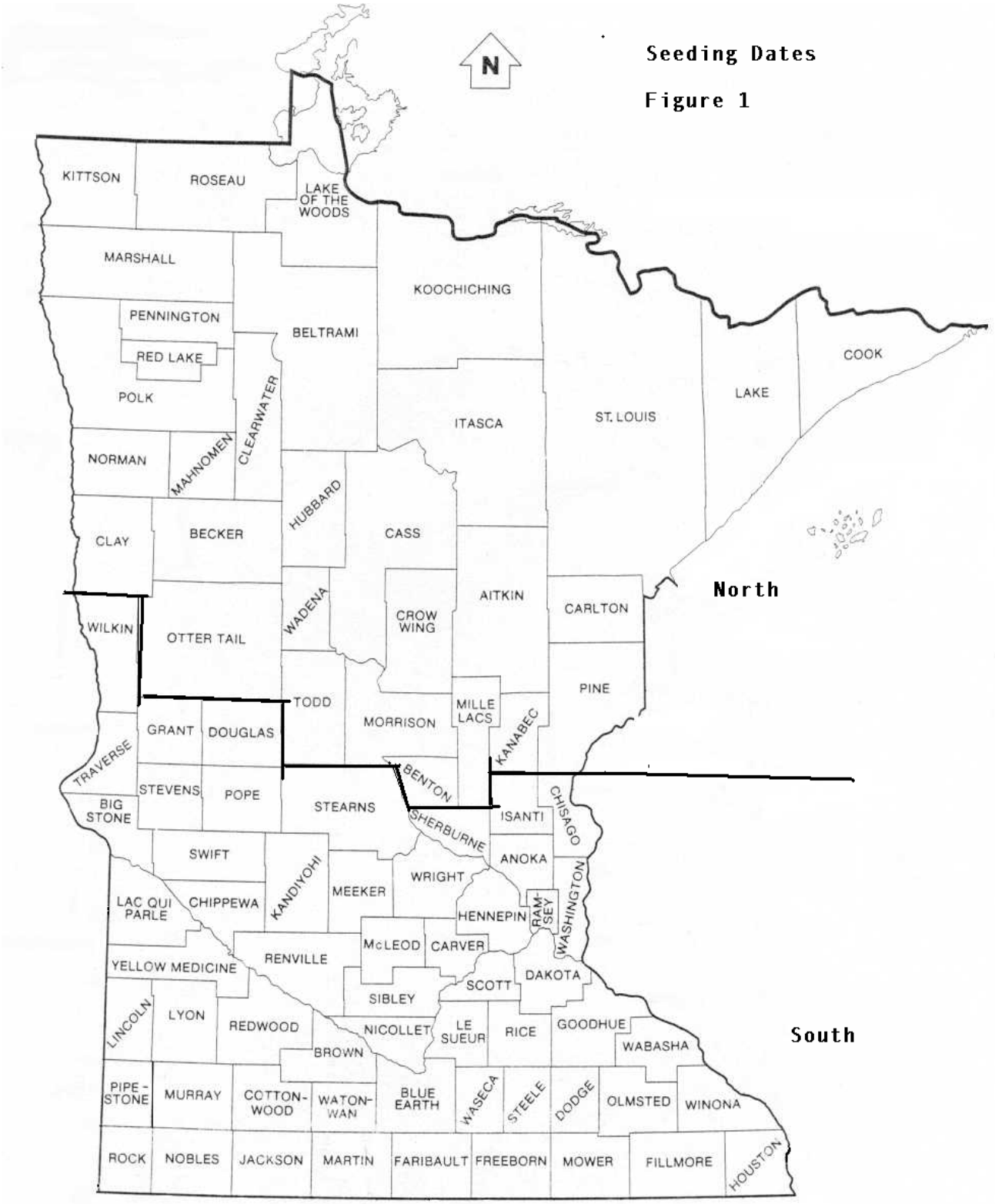
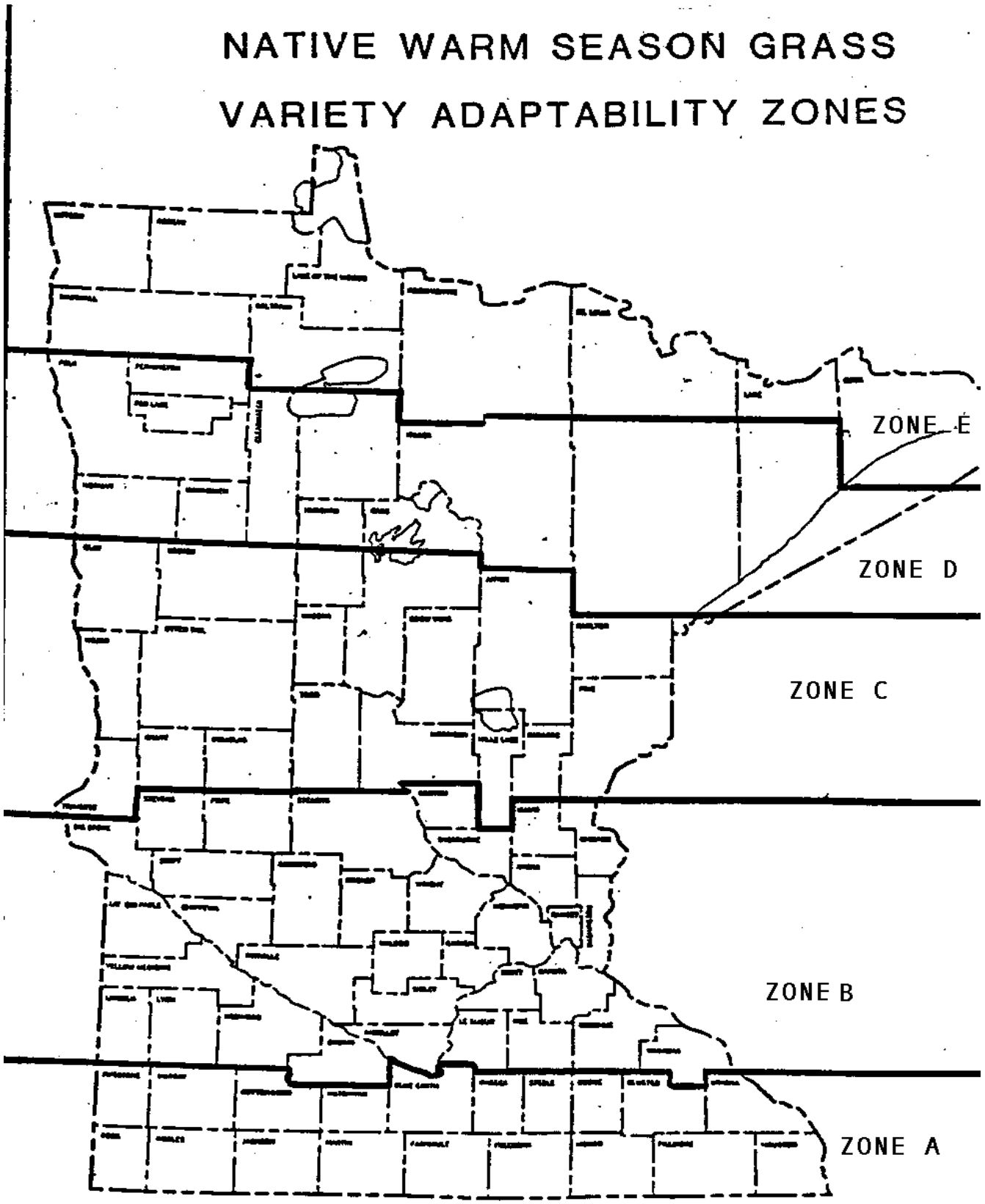

Seeding Dates
Figure 1
N
KITTSON
ROSEAU
LAKE OF THE WOODS
MARSHALL
KOOCHICHING
PENNINGTON
BELTRAMI
RED LAKE
POLK
CLEARWATER
ITASCA
ST. LOUIS
LAKE
COOK
NORMAN
MAHNOMEN
HUBBARD
CASS
CLAY
BECKER
WADENA
CROW WING
AITKIN
CARLTON
North
WILKIN
OTTER TAIL
TODD
MORRISON
MILLE LACS
PINE
GRANT
DOUGLAS
KANABEC
TRAVERSE
BENTON
STEVENS
POPE
STEARNS
BIG STONE
SHERBURNE
ISANTI
CHISAGO
SWIFT
KANDIYOHI
MEEKER
WRIGHT
ANOKA
LAC QUI PARLE
CHIPPEWA
HENNEPIN
RAMSEY
WASHINGTON
McLEOD
CARVER
YELLOW MEDICINE
RENVILLE
SCOTT
DAKOTA
SIBLEY
LINCOLN
LYON
REDWOOD
NICOLLET
LE SUEUR
RICE
GOODHUE
BROWN
WABASHA
PIPE-STONE
MURRAY
COTTON-WOOD
WATON-WAN
BLUE EARTH
WASECA
STEELE
DODGE
OLMSTED
WINONA
ROCK
NOBLES
JACKSON
MARTIN
FARIBAULT
FREEBORN
MOWER
FILLMORE
HOUSTON
South

Figure 2


NATIVE WARM SEASON GRASS
VARIETY ADAPTABILITY ZONES
ZONE E
ZONE D
ZONE C
ZONE B
ZONE A